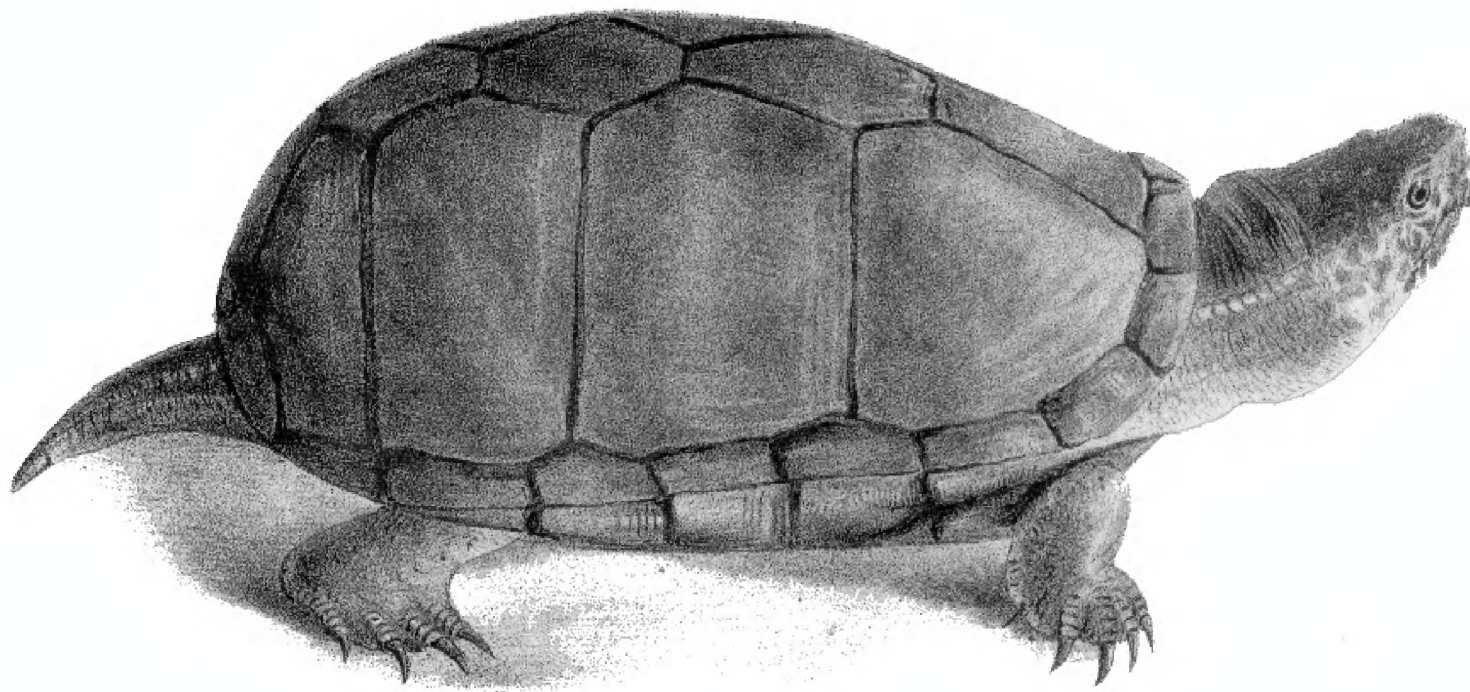

BULLETIN

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Chicago Herpetological Society



Volume 47, Number 9
September 2012



BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY

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Notes on Reproduction of Long-tailed Brush Lizards, *Urosaurus graciosus*
(Squamata: Phrynosomatidae), from California

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Abstract

The reproductive cycle of *Urosaurus graciosus* from California was examined utilizing a histological analysis of museum specimens. Males were reproductively active from March to August. A new minimum size for sexual maturity (SVL = 39 mm) is reported for male *U. graciosus*. Females were reproductively active in spring and summer. Mean clutch size ($n = 19$) was 5.1 ± 1.1 SD, range = 3–7. The smallest reproductively active female (follicles > 4 mm) measured 48 mm SVL. There was a significant positive correlation between female body size and clutch size. Two females from May with oviductal eggs were also undergoing concurrent yolk deposition for a subsequent clutch indicating *U. graciosus* can produce multiple clutches in the same reproductive season. *Urosaurus graciosus* exhibits a reproductive cycle longer in duration (March into August) than occurs in several other southwestern lizard species.

Urosaurus graciosus Hallowell, 1854, ranges from southern Nevada to northwest Sonora and northeast Baja California, Mexico, to central Arizona (Stebbins, 2003). The biology of *U. graciosus* is summarized in Vitt and Dickson (1988). Previous detailed studies on *U. graciosus* from Arizona are by Gates (1963), Vitt and Ohmart (1975) and Vitt et al. (1978). Anecdotal accounts of *U. graciosus* information including months of reproduction and clutch sizes are in: Shaw (1952), Stebbins (1954, 2003), Vitt (1977), Behler and King (1979), Brennan and Holycross (2005, 2006), Lemm (2006), Rau (2009), Stebbins and McGinnis (2012). This paper presents results of a histological examination of *U. graciosus* museum specimens from California. To my knowledge, there is no detailed information on *U. graciosus* reproduction from California. Because of the difficulty of obtaining permits for monthly collections of lizard samples, utilization of museum collections for obtaining reproductive data has become increasingly important. Information on the reproductive biology of lizards such as time of egg and sperm production, clutch size, number of clutches produced are useful in formulating conservation policies (Gibbons, 1994).

Methods

A sample of 122 *U. graciosus* consisting of 64 males (mean snout–vent length [SVL] = $51.0 \text{ mm} \pm 4.9$ SD, range = 39–62 mm), 44 females (mean SVL = $50.8 \text{ mm} \pm 3.0$ SD, range = 46–58 mm), 12 subadults (mean SVL = $41.5 \text{ mm} \pm 2.5$ SD, range = 38–43 mm) and 2 neonates (mean SVL = $25.5 \text{ mm} \pm 0.71$ SD, range = 25–26 mm) was examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM) Los Angeles, California. *Urosaurus graciosus* were collected 1935–1973.

The SVL of each specimen was measured from the tip of the snout to the posterior margin of the vent to the nearest mm. A small incision was made in the lower part of the abdomen and the left gonad was removed for histological examination. Gonads were embedded in paraffin and sections were cut at 5 μm

and stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber, 1997). Histology slides were deposited in LACM. Enlarged follicles (> 4 mm) or oviductal eggs were counted, no histology was performed on them. An unpaired *t*-test was used to test for differences between male and female SVLs; the relationship between female body size (SVL) and clutch size was examined by linear regression analysis using Instat 3 (Graphpad, San Diego, CA).

Results

There was no significant size difference between adult mean male and female body sizes (SVL) unpaired *t*-test, $df = 106$, $t = 0.13$, $P = 0.89$. Monthly stages in the testicular cycle are in Table 1. Two stages of the testicular cycle were present: (1) recrudescence, a proliferation of germ cells for the next period of spermiogenesis (sperm formation) is under way. Primary spermatocytes are the predominant cells; (2) spermiogenesis, lumina of the seminiferous tubules are lined by sperm or clusters of metamorphosing spermatids. Males were reproductively active from March to August. In one male from October (LACM

Table 1. Monthly stages in the testicular cycle of 64 *Urosaurus graciosus* males from southern California. * = residual sperm in lumen, germinal epithelium exhausted.

Month	N	Recrudescence	Spermiogenesis
March	2	1	1
April	27	3	24
May	21	1	20
June	3	0	3
July	5	0	5
August	4	0	4
October	2	1	1*

Table 2. Monthly stages in the ovarian cycle of 44 *Urosaurus graciosus* females from southern California. ** = 2 females with oviductal eggs and concurrent yolk deposition. * = 1 female with oviductal eggs and concurrent yolk deposition.

Month	N	Quiescent	Early yolk deposition	Follicles > 4 mm	Oviductal eggs
April	10	3	2	5	0
May	25	12	2	9	2**
June	1	1	0	0	0
July	2	2	0	0	0
August	4	1	0	1	2*
September	1	1	0	0	0
October	1	1	0	0	0

18904), the germinal epithelium of the seminiferous tubules was exhausted but residual sperm, produced in summer, remained in the lumina. The smallest reproductively active male (spermiogenesis in progress) measured 39 mm SVL and was collected in April (LACM 115646).

Monthly stages in the ovarian cycle are in Table 2. Four stages were present: (1) quiescent, no yolk deposition in progress; (2) early yolk deposition; (3) enlarged ovarian follicles (> 4 mm); (4) oviductal eggs. Females were reproductively active in spring and summer (Table 2). Two May females with oviductal eggs (LACM 18894, 97810) were also undergoing concurrent yolk deposition for a subsequent clutch, as was one August female (LACM 37813). Mean clutch size ($n = 19$) was 5.1 ± 1.1 SD, range = 3–7. The smallest reproductively active female (4 follicles > 4 mm) measured 48 mm SVL (LACM 97791) and was collected in May. A series of 12 female *U. graciosus* smaller than 48 mm SVL (mean = $41.6 \text{ SVL} \pm 2.5 \text{ SD}$, range 38–44 mm) was found to contain quiescent ovaries. Thus 48 mm SVL likely approximates the minimum size for *U. graciosus* female reproduction in California. Linear regression analysis indicated there was a significant positive correlation between female body size and clutch size ($n = 19$, $r = 0.51$, $P = 0.02$). This relation is shown by the equation: $Y = -7.74 + 0.25X$. Two neonates measuring 25 mm SVL (LACM 18891) and 26 mm SVL (LACM 22336) were collected 20 November and 13 September, respectively.

Discussion

Vitt et al. (1978) reported the smallest male with sperm in the testis from Arizona measured 42 mm SVL. My finding of a male undergoing spermiogenesis at 39 mm SVL is a new minimum size for reproductive maturity for *U. graciosus* males.

A correlation between spring rainfall, associated resource levels and reproductive success in *U. graciosus* was reported by Vitt et al. (1978). As my samples come from a range of years (1935–1973), I could not examine this relationship, although differences in the onset of female reproductive activity in *Sceloporus occidentalis* from southern California were noted in years of varying rainfall (Goldberg, 1975a). Vitt et al. (1978) reported the smallest reproductive *U. graciosus* female from Arizona

measured 44 mm SVL and the largest measured 66 mm SVL. This range of mature females is slightly larger than I recorded (48–58 mm SVL) for this species from California. Gates (1963) reported a mean clutch size of 4.6 ± 0.4 , range = 2–7 for 12 *U. graciosus* and Vitt and Ohmart (1975) reported a mean clutch size of 5.3, range 3–10 ($n = 23$) from Arizona. The presence of 2 May females with oviductal eggs and concurrent yolk deposition indicates *U. graciosus* can produce multiple clutches in the same reproductive season. This was previously reported by Vitt and Ohmart (1975), Vitt (1977) and Vitt et al. (1978). Regarding the August *U. graciosus* female with oviductal eggs and concurrent yolk deposition, because of the late time in the reproductive season, it is not known if an egg clutch would have been produced or if the vitellogenic follicles would have undergone atresia (= spontaneous degeneration). Incidences of follicular atresia increase late in the reproductive season when vitellogenic follicles that do not ovulate are reabsorbed (Goldberg, 1973, 1975b).

Other reports of *U. graciosus* reproduction from California are similar to my findings: a clutch of 4 eggs deposited on 19 May in San Diego County (Shaw, 1952); 1–2 egg clutches of 4–5 eggs deposited May to August (Stebbins and McGinnis, 2012); 1–2 clutches of as many as 10 eggs (Lemm, 2006).

The two neonates reported were within the size range of *U. graciosus* neonates from Arizona (19–27 mm) reported by Gates (1963).

Urosaurus graciosus exhibits a reproductive cycle longer in duration (March into August) than occurs in several other southwestern lizard species, for example, *Dipsosaurus dorsalis* (Mayhew, 1971), *Sceloporus occidentalis* (Goldberg, 1974), *Sceloporus vandenburgianus* (as *Sceloporus graciosus*) (Goldberg, 1975b), *Phrynosoma blainvillii* (as *Phrynosoma coronatum*) (Goldberg, 1983) in which reproduction commences in spring and concludes in July.

Acknowledgment

I thank G. Pauley (LACM) for permission to examine *U. ornatus*.

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Appendix

Specimens of *Urosaurus graciosus* from California (by county) examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM).

California: **Imperial**: LACM 8896, 18894, 18897-18904, 18906-18910, 37811-37814, 52837, 61949, 97740 97747, 97749, 123400.

Riverside: LACM 18891-18893, 22329-22333, 22335, 22336, 22338, 27364-27367, 52838, 52839, 52841, 62489, 97752-97761, 97763, 97764, 97767-97770, 97773-97777, 97778, 97780-97798, 97800-97809, 115646, **San Bernardino**: LACM 18888, 18889, 21904, 70248, 70249, 70251-70253, 97810, 97812-97817, 97819, 139661-139663. **San Diego**: LACM 27368.

This book was reviewed favorably, although with some reservations, in these pages by Dave and Tracy Barker shortly after it appeared [Bull. Chicago Herp. Soc. 43(11):177-178]. Here's another review, also favorable, but from a different perspective.

**Book Review: *The Lizard King, The True Crimes and Passions of the World's Greatest Reptile Smugglers* by Bryan Christy. 2008. Twelve, New York and Boston.
ISBN-13: 978-0-446-58095-3. Hardcover / Paperback / E-book.**

**Drew Newman
3409 E. Medicine Lake Blvd.
Plymouth, MN 55441**

A wonderful thing about nonfiction as a genre is that sometimes arcane subject matter can draw in uniquely qualified writers. Bryan Christy exemplifies this. Once a Washington, D.C., attorney, he traded in his scripted and robotic life to work as a freelance journalist for *National Geographic*.

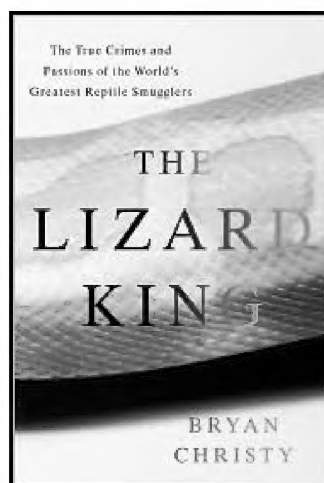
The Lizard King is his first book and it's a majestic effort. It is so stunningly well written and pays such meticulous attention to detail that both the gentle reader and the hardened literary critic should enjoy it immensely.

The book is about reptile smugglers, with a fascinating backstory on the community of insanely obsessed private collectors and breeders. From 1989 to 1994 this reviewer was deeply involved in that subculture. As the first few chapters chronicle, it was the business known as Strictly Reptiles that the Feds were going after. What makes this review highly personal is that this was the company I bought all my breeding stock from.

Eighteen years ago I walked away from the herpetocultural lifestyle and mostly forgot about my friends and acquaintances in the industry. This book tells what happened to some of them shortly afterward.

The first chapter describes the arrest of an Argentine national who gets busted with a suitcase full of tortoises. Christy teases us with this little detail of the end game the way a snake would toy with a mouse. Also quite prominent here are brief biographies of a few of the major importers and breeders. Tommy Crutchfield's legal difficulties are a nice juxtaposition to what is happening at Strictly Reptiles. The dotcom bubble of investment grade reptile breeding is eloquently portrayed in the following passage: "In a reptilian version of *Jack and the Beanstalk*, a young Detroit man borrowed from his mother, flew to Oklahoma City, and bought \$50,000 worth of . . . albino Burmese pythons. . . . Four years later . . . [he] and his wife bought a \$1.2 million Florida property. . . ."

The book moves on with the intriguing story of the owners of Strictly Reptiles, Mike Van Nostrand and his father Ray. The absolute obsession of Ray as he is building this business is related through the wonderful storytelling of the author as if he were a first-person observer. Later, after the father is busted for drugs and Mike takes over, we move into the present day. Also in the book is a poignant accounting of the progression of reptile keeping. One cannot help but see how seriously analogous this is to the trajectory of a substance abuse problem. Many hobbyists go through the stages of bigger, cooler, rare and endangered. Ultimately, these incremental steps lead them to the doors of



Strictly Reptiles.

Christy's writing sheds light on the cultural workings of the economic engine which powers the smuggling industry. As the individual and collective needs for more exotic animals grow, the Van Nostrands happily feed upon this lucrative specialty niche. As I have personally observed, Strictly Reptiles on a busy day resembles a high volume crack house.

Also well detailed is the little dance of "don't ask, don't tell" that is played out every day between customer and importer. As most buyers will not purchase animals that were obviously smuggled, a little word game is played. "Captive-born" seems to be the abracadabra phrase that can make thousands of dollars change hands in an instant. Often customers will check rational logic at the door when trying to procure animals they desperately want. "Yes there are only 1500 left in the wild," the buyer will think, "but Mike says they were captive-born in Germany and he's seen the paperwork. That's good enough for me." With a few phone calls the importer makes twenty large and the customer gets a visit from Santa Claus driving a FedEx truck in July.

Intertwined into an already captivating tale is the parallel drama of the U.S. Fish and Wildlife agents chasing the smugglers. Christy has you laughing as he recounts the story of one law enforcement official who, with utter sincerity, tries to convince a prosecutor to take on the case of a guy illegally selling barn owls. He also delves deeply into both the personal and professional lives of the men and women on this case as they approach the holy grail of their careers—busting Strictly. The particular portrayal of one operative is so well concealed that when you learn his true identity you are stunned. Shades of M. Night Shyamalan there.

This book will make you think. If you are an armchair conservationist, it will tweak your mind and perhaps reconfigure your ethics. Personally, I remember Tommy Crutchfield when he explained to me his now famous "conservation through commercialization" philosophy. Throughout the book Christy seems to give some credence to this belief. He also gives us the perspective of the recently captured reptile in a holding pen in Indonesia. Through anthropomorphic literary license he wonders who the animal would rather see: the live animal smuggler or the guy from the boot factory.

This book provides no easy answers and poses morally ambiguous questions. In a world where in a few years the eco-splendor of Madagascar will resemble a Wal-Mart parking lot, what do we do? Are smugglers inadvertently sailing a Noah's Ark for dangerously imperiled species? Bryan Christy doesn't answer these questions, but like the good attorney he was, he lays out meticulously detailed evidence. In his courtroom of the nonfiction genre, he lets you be the judge.

What You Missed at the August Meeting

John Archer
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Roger Repp should be writing this. I told him that. He declined. I suppose that he felt giving the August presentation was enough work, but you've missed out on some really fun writing if you haven't read any of Roger's stuff. Go to the Tucson Herpetological Society's web site and check the archives for some of his output. The effort won't be wasted. He writes a lot better than I. In fact, for many a month after I began writing these pieces of illiteracy, I was frequently begged to "write like Roger," and only the slow realization that I would never scale those reverent heights caused the cajoling to cease.

So maybe you don't know Roger Repp, but you should. He's been a CHS member longer than he'd like to admit, starting in the Chicago area but moving to Tucson some 30 years ago. He is past president of the Tucson Herpetological Society and in his spare time is normally found wandering around the deserts of Arizona in search of animals most people would like to avoid. And he's one of the best speakers we can get. You missed a good talk if you didn't make the meeting in August. Roger's folksy, down-home, aww-shucks delivery is carried into his everyday persona, but that self-deprecation hides a razor-sharp mind that delivers really great quips while doing acclaimed field work. Indeed, Roger has been involved with radio-tracking Arizona rattlesnakes for many years, providing data for several academic papers. And he's a lot of fun in the field.

His talk was titled "Burrow Buddies—Or Not? (Or...What's Up with That?)." Drawn from his many years of peering into holes in the desert, Roger massaged a talk he'd given to the Desert Tortoise Council last year and a talk he'd presented to the Tucson Herpetological Society into a talk for us. We got the



Roger Repp. Photograph by Ralph Shepstone.

best of both worlds. He opened with a shot of a shiny-eyed skunk in a burrow with a Sonoran desert tortoise (*Gopherus morafkai*) and explained that he hadn't seen this often and rarely will both those animals share a burrow. Lifting a line from the '70s hit "A Horse with No Name," Roger made the point that "The desert is an ocean with its life underground," while casting aspersions upon three-chord mega-hits. When you field herp in that habitat you look in every hole. An "aaaww" photo of cute bobcat kittens showed that not all the rewards involve herps.

But he started with occurrences of tortoises and snakes because that was what the Desert Tortoise Council had asked him to cover. With around 2,500 trips involving about 20,000 hours in the field since 1989, Roger has the experience to talk about nearly every aspect of desert fieldwork, and he maintains meticulous notes that allow him to discover he's had 52 observations of tortoises and snakes in the same hole. Stressing that his observations fall within a 50-mile radius of Tucson, he flashed photos of the snakes encountered. A photo of western diamond-backed rattlesnakes (*Crotalus atrox*) in combat illustrated the snake species that accounted for most of the cohabitations, followed by cool photos of the two other species that were observed in the same holes with tortoises, black-tailed rattlesnakes (*Crotalus molossus*) and tiger rattlesnakes (*Crotalus tigris*). Knowing his audience can never get enough of great snake pictures, Roger continued through a list of species that possibly could be found collocated with the tortoises or had been observed by others. We saw slides of Mojave rattlesnakes (*Crotalus scutulatus*), sidewinders (*Crotalus cerastes*) and Arizona black rattlesnakes (*Crotalus cerberus*). Lyresnakes (*Trimorphodon lambda*) filled crevices and pack rats peered from behind their vegetative barriers.



The main interest of the Desert Tortoise Council and what prompted Roger's presentation, a Sonoran desert tortoise (*Gopherus morafkai*). Photograph by R. A. Repp.



The species Roger spends most of his time with, western diamond-backed rattlesnakes (*Crotalus atrox*). Two males in combat. Photograph by R. A. Repp.



In March 2006 these western diamondbacks emerged from their den to drink. Weather: 3 °C, rain/sleet, 50 mph winds. Photograph by R. A. Repp.

A gorgeous slide of several diamondbacks at the mouth of a rocky den was the backdrop for two interesting points. While Roger has found 52 instances of tortoises sharing the same hole with snakes in all of his field experiences, during ten years of radio-tracking efforts he has only recorded two cases of such commensalism. Seems more should have been found, but Roger proposed that the terrain where he typically radio-tracks has many rocky lairs that, while attractive to snakes and Gila monsters, are unsuitable for tortoises because they can't fit and the rocks prevent burrowing. The other interesting point about the slide was the label. Taken in March on a day with rain and sleet and 50 mph winds coming after a long drought, the photo shows the diamondbacks drinking—despite an air temperature of 3 °C (37 °F). Proof that these desert animals will brave extreme conditions when necessary.

At one point Roger mentions that he put in 80 hours preparing his presentation. Some people may have thought that a joke, but I know Roger keeps copious notes and I find that figure totally credible. He broke down his encounters by totals of each species found and then the actions of the observed individuals. Pictures of rattlesnakes hogging the limelight and tortoises skulking in the rear came up. A photo of a single diamondback raised in a combat pose had the label “Bowling for atrox,” and Roger told of the startled tortoise that plowed through a mass of mating snakes to escape Roger's approach, causing the snakes to fly everywhere and the male to take offense and demand snake-on-tortoise combat. The tortoise refused to participate and remained below ground. So many hours of intense study in the



This is what the talk was all about. Photograph by R. A. Repp.



Even though he took this shot, Roger says he has never seen a rattlesnake with a Gila in the wild. He didn't see the rattlesnake until he was looking at the picture days after he took it! Photograph by R. A. Repp.

field occasionally exposes one to such dramatic experiences.

The next few slides illustrated another story. A habitat shot of a desert ledge was followed by a photo of a tortoise apparently pinning a black-tailed rattlesnake against the back of a hole. Roger made “gronking” noises as he demonstrated the sound that drew him to this scene. The tortoise was actively attacking the snake in an apparent attempt at ridding the burrow of its presence. The snake seemed to not be taking the hint, and simply shifted a little as the tortoise smashed, rammed and bit. Three hours later when Roger returned, the “gronking” continued and the snake was still intruding.

Roger then expanded his talk to commensalism other than tortoises with snakes and included examples from elsewhere than Arizona. Striped whipsnakes (*Coluber taeniatus*) crowded in with Panamint rattlesnakes (*Crotalus stephensi*), or lazing with a Great Basin rattlesnake (*Crotalus oreganus lutosus*), and another “aaaawww” moment was generated by a photo of four whipsnake heads stacked and peering from a vertical crack. Coachwhips (*Coluber flagellum*) and California mountain kingsnakes (*Lampropeltis zonata*) lit the screen. An Arizona black rattlesnake (*Crotalus cerberus*) and an alligator lizard



A desert tortoise eyes a Sonoran desert toad (*Ollotis alvaria*) at the entrance to its shelter. Photograph by Taylor Edwards.



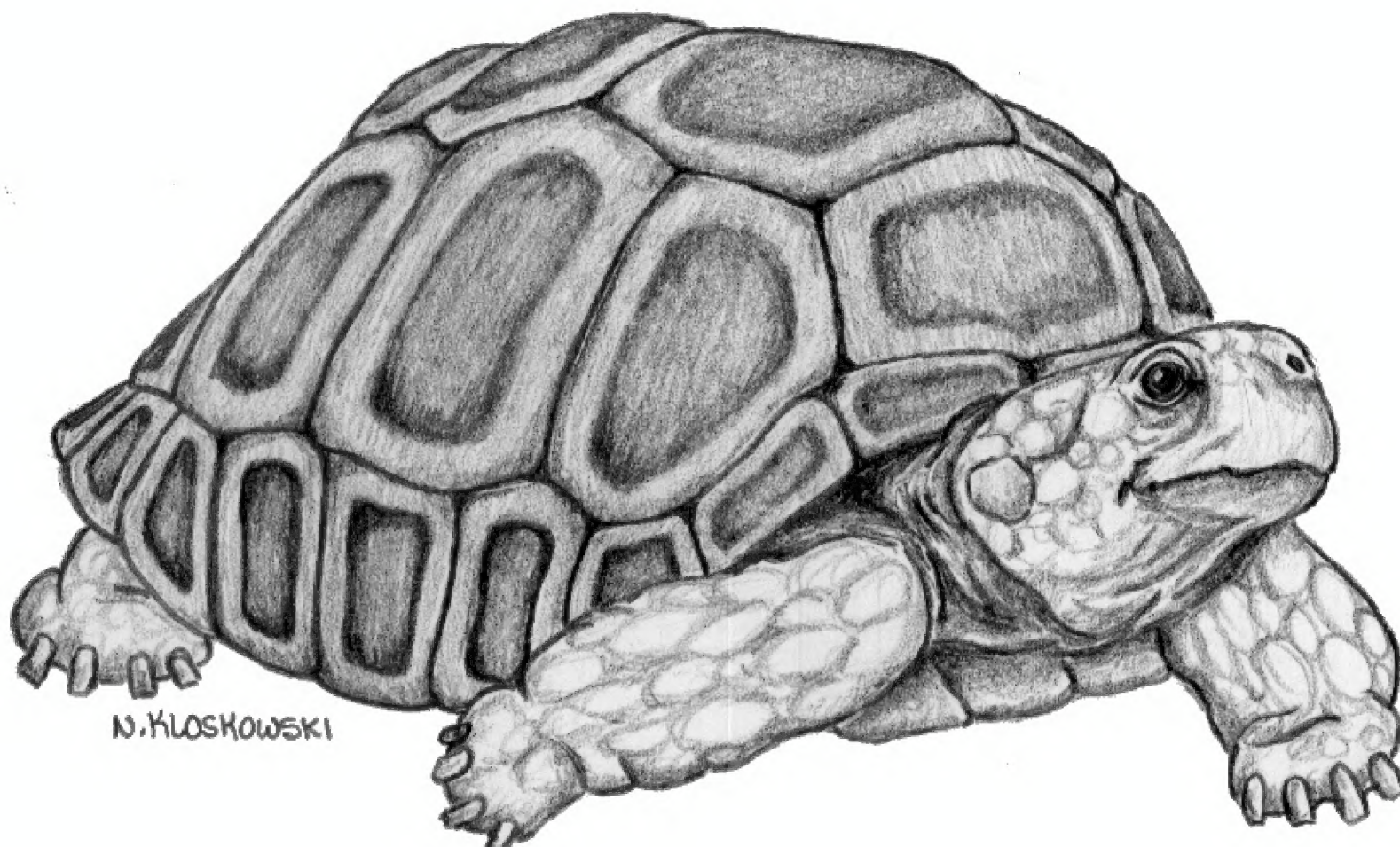
Just a cool picture of a Mojave rattlesnake (*Crotalus scutulatus*).
Photograph by R. A. Repp.

(*Elgaria kingii*) shared a narrow crevice, while Gila monsters appeared with tortoises and snakes. Different species of rattlesnakes were also illustrated as roommates. Roger was building to his question. Many of these animals will eat each other, so why don't they? After tossing out various thoughts and soliciting ideas from the audience, Roger concluded that the animals were in the same holes because, "It may just be that the chosen shelter suits both parties in question" (RAR, CHS *Bulletin* 33(3):49-56, March 1998), and they don't eat each other because of food preferences (herbivorous) or because they can't due to body mass (too large) or temperature (too low to trigger a feeding response).



Gila chillin' (*Heloderma suspectum*).

Early in his Roger's presentation came a slide of a desert tortoise followed by a slide of a Gila monster with a diamond-back, both bearing the label "Nobody here loves these more!" No one who knows Roger would argue that point too much. But to bring the discipline and rigorous observational skills that Roger continually demonstrates requires much more than just a love for the animals. Few people possess Roger's talents, and fewer still manage to use them so fully with such apparent ease. Roger finished with his radio announcer voice while speaking over a slide showing two tortoises in combat, a gorgeous kingsnake, and a pair of strutting whiptail lizards, saying, "This is Roger Repp signing off from southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are way above average." Certainly at least one of its herpers is also way above average.



Herpetology 2012

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

ARE REPTILIAN MOMS JUST SELFISH?

L. Schwarzkopf and R. M. Andrews [2012, *Herpetologica* 68(2): 147-159] note that recent discussion in the literature has examined "adaptive maternal effects," defined as maternal effects that benefit offspring, and concluded that this definition is too narrow, because maternal effects may not always benefit current offspring fitness, but can still be adaptive to female lifetime reproductive success. The "maternal manipulation hypothesis" suggests that females modify their physiology and behavior when gravid to increase offspring fitness, an example of adaptive maternal effects in the narrow sense. The maternal manipulation hypothesis has been tested almost exclusively using studies of reptiles, especially viviparous species. The authors argue that interpretations of modifications of female reptile behavior and physiology while gravid are hampered by the maternal manipulation hypothesis' exclusive focus on offspring fitness. They suggest broadening the approach of such studies to attempt to determine whether behaviors benefit fitness of the current batch of offspring, or benefit female lifetime reproductive success, or both. Using this approach, researchers acknowledge that females may modify physiology and behavior when gravid to benefit their own lifetime reproductive success, which may, or may not, also enhance fitness of the current batch of offspring. They recommend tests of benefits to include the idea that females may increase their lifetime reproductive success by engaging in specific behaviors while gravid, independent of (or in addition to) benefits to offspring. They conclude that a broader view of maternal effects, less focused on offspring fitness and including both mothers and offspring, is the way forward for understanding maternal effects.

MANIPULATIVE MOTHERS AND SELECTIVE FORCES

R. Shine [2012, *Herpetologica* 68(3):289-298] notes that in many taxa of squamate reptiles, thermal conditions during incubation affect fitness-relevant phenotypic traits of the offspring. Therefore, a gravid female can enhance the fitness of her offspring by selecting appropriate thermal regimes. The maternal manipulation hypothesis attributes phylogenetic shifts in a broad array of maternal traits (such as nest-site selection, prolonged uterine retention of eggs, and shivering thermogenesis) to selective advantages driven by embryonic developmental plasticity: mothers enhance the viability of their offspring by providing "better" incubation conditions. In *Herpetologica* 68(2):147-159, Schwarzkopf and Andrews pointed out an alternative possibility: that reproduction-induced shifts in maternal thermoregulatory tactics have evolved because they enhance maternal, not offspring, fitness. Shine argues that although possible on logical grounds, this alternative hypothesis is inconsistent with available evidence on squamate biology, especially with the diversity of thermoregulatory modifications induced by reproduction. Most reproduction-associated shifts in maternal thermoregulation likely reflect benefits to offspring, or are nonadaptive consequences of ecological shifts that are enforced by reproduction.

MATERNAL MANIPULATORS, SELFISH MOTHERS, OR BOTH?

D. F. DeNardo et al. [2012, *Herpetologica* 68(3):299-307] note that during reproduction, females often modify their behavior relative to the nonreproductive condition. These changes are frequently attributed to maternal efforts to optimize offspring development and survival (i.e., the maternal manipulation hypothesis). However, Schwarzkopf and Andrews (2012) recently challenged this concept as oversimplified, emphasizing that females should optimize their own lifetime fitness, and therefore maternal efforts may be directed at the female's future reproductive effort in addition, or even in contrast, to current reproductive effort. To provide insight into the relative importance of current versus future reproductive effort in shaping maternal behavior, the authors systematically explore a single study system—pythons. Pythons show distinct maternal behaviors during gravidity (modified basking effort), peri-oviposition (nest site selection), and postoviposition (egg brooding). They argue that examining each component reveals that python maternal effort is predominantly aimed at current offspring. Yet, at times, females will make decisions that benefit their future reproductive potential at a cost to their current effort. Therefore, maternal behavior likely reflects a focused effort to maximize fitness through optimizing current reproductive investment, but such effort is not without consideration of future reproductive potential.

MORE ON MATERNAL MANIPULATION

L. Schwarzkopf and R. M. Andrews [2012, *Herpetologica* 68(3): 308-311] maintain that females should behave in ways that maximize lifetime reproductive success (the "selfish mother" hypothesis [SMH]). Very often, this will mean that female behavior during reproduction maximizes fitness of the current batch of offspring. In some cases, however, females may maximize lifetime reproductive success by behaving in ways that are neutral, or even detrimental, to current offspring fitness. The "maternal manipulation hypothesis" (MMH), proposed by Shine, argues that females should behave in ways that maximize fitness of the current batch of offspring. Schwarzkopf and Andrews argued in the previous issue of *Herpetologica*, however, that if researchers focus solely on measuring benefits to offspring of female behavior during reproduction, they will not consider the possibility that female behavior is neutral or even detrimental to offspring fitness, thereby missing an important facet of behavior during reproduction. Here these authors reply to comments by Shine (2012) and DeNardo et al. (2012), mainly to emphasize the point that contrasting the MMH and the SMH as if they operated exclusively and independently is not productive, because females enhance their lifetime reproductive success by enhancing current offspring fitness or their own long-term fitness, or both.

ORNATE BOX TURTLES IN NORTHWEST ILLINOIS

J. M. Refsnider et al. [2012, *Chelonian Conservation and Biology* 11(1):78-83] note that the destruction of prairies has led to the decline of the ornate box turtle (*Terrapene ornata*) across much of its range. Land management agencies are considering translocation programs to restore populations to areas from which they have been extirpated. For these conservation efforts to be successful, long-term posttranslocation monitoring is necessary to ensure that translocated individuals behave and use habitat similarly to unmanipulated individuals. The authors conducted a 3-yr radiotelemetry study of a potential source population of ornate box turtles to provide baseline data on home range size and site fidelity pretranslocation. Adult males and females did not differ in minimum convex polygon home range size (mean 4.0 ha), 95% fixed kernel home ranges (mean 2.6 ha), or 50% fixed kernel home ranges (mean 0.4 ha). Both sexes showed high site fidelity to annual home ranges and to previously used overwintering sites, although distance between subsequent overwintering sites was less for females than for males. At the study site, ornate box turtles have relatively small home ranges and exhibit strong site fidelity. Translocation programs for this species should closely monitor movements of translocated individuals to assess whether they are successfully establishing new home ranges or attempting to return to their site of origin. Moreover, the high site fidelity exhibited by this species suggests that newly translocated individuals may be at increased mortality risk because they are unfamiliar with suitable overwintering and/or nesting sites in their new location. These results will be used to ensure that sites to which animals are translocated are comparable to the site of origin in terms of home range size requirements and important habitat features. In addition, the data serve as a critical baseline to which the habitat use and movement patterns of monitored animals posttranslocation can be directly compared to assess the success of the translocation.

INSECTICIDE IMPACTS ON PREDATORS AND PREY

J. L. Kerby et al. [2012, *J. Herpetology* 46(2):171-176] examined the combined effects of sublethal concentrations of the pesticide diazinon and a non-native predatory fish on the behavior and survival of amphibian prey (*Pseudacris regilla* tadpoles). A 48-h experiment was performed in tubs containing predatory western mosquitofish and diazinon treatments (0, 0.5, 1.0 mg/L, and a solvent control). In “no-pesticide” treatments, the presence of fish reduced tadpole survival significantly. In the absence of fish, pesticide presence altered tadpole behavior (reduced refuge use) significantly but did not impact tadpole survival. In the combined presence of both fish and pesticide, tadpoles altered their behavior to become more active, and to hide less. Although these behavioral changes should expose tadpoles to an even higher predation risk, because diazinon also reduced both activity and attack rates by the predatory fish, tadpoles experienced significantly greater survival in treatments with pesticides. Despite the negative impact of diazinon on amphibian antipredator behavior, the stronger impact of diazinon on predator behavior allowed a greater survival rate for the prey. These results demonstrate the importance of studying specific species interactions in understanding the impacts of chemical contaminants on any given species.

FASTER BUT NOT STICKIER

P. H. Niewiarowski et al. [2012, *J. Herpetology* 46(2):194-197] note that the house gecko, *Hemidactylus frenatus*, is one of the world’s most invasive vertebrate species and is spreading rapidly across the South Pacific, displacing other species of geckos that are native or were already resident. They studied the adhesion and locomotor capabilities of *H. frenatus* and the resident *Lepidodactylus lugubris* on the island of Moorea in French Polynesia where they are syntopic. The goal was to determine whether *H. frenatus* could stick or sprint faster than *L. lugubris*, two types of performance measures that could underlie superiority of *H. frenatus* in foraging and agonistic interactions hypothesized in other studies. The clinging ability of *H. frenatus* and *L. lugubris* are comparable suggesting that the potential for sticking to vertical and overhanging surfaces as geckos move through their environments does not differ between species. In contrast, *H. frenatus* have maximal sprint speeds that are approximately fourfold higher than *L. lugubris*, an advantage in speed that is even greater than that measured previously for the two species running on horizontal surfaces. Proposed superiority in foraging and agonistic interactions of *H. frenatus* compared to *L. lugubris* are potentially traceable to performance characteristics such as adhesion and locomotion. The authors demonstrate that comparatively high maximal locomotor speeds may contribute to the observed success of *H. frenatus* over resident geckos in French Polynesia, and possibly in other areas where they have been introduced.

OLIVE RIDLEY MASS NESTING ECOLOGY

R. A. Valverde et al. [2012, *Chelonian Conservation and Biology* 11(1):1-11] note that the olive ridley sea turtle (*Lepidochelys olivacea*), a species listed by the International Union for Conservation of Nature as vulnerable, is characterized by its mass-nesting behavior, also known as arribada. For decades, this phenomenon has facilitated the utilization of this species by coastal communities, much of it illegally. At Ostional beach, Costa Rica, a community-based egg-harvest program operates legally to generate important income for the community while promoting the protection of the ridley nesting assemblage. However, to date, no analysis exists that indicates the long-term viability of the egg harvest program as a sound management tool. To address this void, the authors generated baseline abundance data of the major arribada events that occurred in the period 2006–2010, as well as egg harvest data, along with preliminary hatching success. Arribadas ranged between 3564 and 476,550 egg-laying females, which indicated a large variability in the magnitude of the mass nesting events. Estimated mean egg harvest was 4746.4 clutches, ranging from 1527 to 8138. In relation to the estimated number of clutches laid, the estimated mean of clutches harvested was 21.2%, ranging from 1.5% to 102.4%. Estimated monthly mean hatching rates ranged from 0.0% to 32.6%. It is not clear whether arribadas underwent a significant change in abundance during the study period. Although the number of years covered is too short to establish a long-term trend, when compared with historical data the population appears to have declined. Various management recommendations aimed at increasing hatching rates are presented.

STREAM SALAMANDERS AND DROUGHT

S. J. Price et al. [2012, *Herpetologica* 68(3):312-323] note that drought is a significant stressor to aquatic animals. However, empirical data regarding the response of many aquatic animals, particularly amphibians, to drought are limited. The southeastern U.S. experienced a suprasedational drought in 2007–2008, which provided an opportunity to examine the resistance and resilience of salamanders to drought. The authors used 5 yr of presence–absence data at 17 first-order streams and 61 mo of mark–recapture data at one stream to examine the effects of drought on occupancy and vital rates of northern dusky salamanders, *Desmognathus fuscus*. Three hypotheses were tested as to the effects of drought: larvae would decrease in occupancy during drought, but adult occupancy would remain stable; adult temporary emigration rates would be greatest during suprasedational drought conditions; and adult survivorship would be equal or nearly equal during nondrought conditions and drought conditions due to higher rates of temporary emigration. It was found that adult salamander occupancy remained stable through the 5 yr of sampling; however, larval salamander occupancy decreased by an average of 30% during the suprasedational drought. It was also found that adult temporary emigration probabilities were twice as high during suprasedational drought conditions than during nondrought or typical drought conditions. Monthly survival of adults was relatively high during nondrought, typical drought, and severe drought conditions. These findings suggest that high survivorship of adult *D. fuscus* likely buffers the negative effects of drought on larvae and high rates of temporary emigration allow adult salamanders to be resilient to suprasedational drought conditions.

ARTIFICIAL VERSUS NATURAL INCUBATION

K. M. Noel et al. [2012, *Herpetologica* 68(3):324-333] report that recent studies have found that gopher tortoise, *Gopherus polyphemus*, populations in southern Mississippi exhibit low recruitment, due in part to very low hatching success. They sought to determine if the cause(s) of this low hatching success was related to egg quality (intrinsic factors), unsuitability of the nest environment (extrinsic factors), or a combination. In 2003, hatching success was monitored simultaneously for eggs from the same clutches that were incubated in the laboratory and left to incubate in nests. A subset of randomly chosen eggs from each clutch was incubated in the laboratory under physical conditions known to be conducive to successful hatching to estimate the proportion of eggs that were capable of hatching in a controlled setting. Hatching success in the laboratory was compared with that of eggs incubated in natural nests to estimate the proportion of eggs that failed to hatch presumably from extrinsic factors. Laboratory hatching success was 58.8%, suggesting that roughly 40% of the eggs were intrinsically incapable of hatching even when incubated under controlled conditions. Hatching success in natural nests, 16.7%, was significantly lower than hatching success in the laboratory, suggesting that approximately 42.1% of eggs were capable of hatching but failed to hatch due to some extrinsic aspect(s) of the nest environment. Thus, the low hatching success of gopher tortoise eggs in southern Mississippi appears to be attributable to a combination of intrinsic (egg quality) and extrinsic (nest environment) factors.

GOPHER TORTOISES IN A PINE PLANTATION

B. A. DeGregorio et al. [2012, *Chelonian Conservation and Biology* 11(1):50-58] studied long-term *Gopherus polyphemus* population dynamics, burrow distribution, and habitat use at Plum Creek / Lochloosa, a pine plantation in northern Florida. Mark–recapture surveys were conducted on this study site during the 1980s, and a follow-up survey was done in 1992. The ca. 66-ha study area is a mosaic of moderately well-drained and poorly drained soils, and has had a history of clear-cutting. Recent management activities included a tree thinning in 2008 and a controlled burn in winter 2009. The authors located gopher tortoise burrows during late April and early May 2009, and captured tortoises in pitfall or wire traps during May–July. Fifty-two tortoises were captured on the study site and 4 others in an adjacent pine plantation across a paved rural road. Seventeen of the tortoises (33%) had been previously marked, including a male marked as a mature adult in 1982. Most (88%) marked individuals were found in the same approximate location (within 200 m) as during earlier surveys, despite the silviculture-related habitat changes over time. Only 8% of all marked ($n = 211$) tortoises were recaptured in 2009. Recapture rates were 4% for tortoises marked when immature, 10% for adult males, and 21 % for adult females. Drill marks held up relatively well in adult tortoises but were difficult to discern in some tortoises marked as juveniles. Size and sex class distributions of tortoises captured in 2009 were different from those observed during 1981–1987 and 1992, primarily because fewer juveniles were captured in 2009. This follow-up survey indicated that viable gopher tortoise populations can persist on sites undergoing intensive silviculture, and it further substantiated tortoise use of windrow berms, ecotones, and relatively well-drained soils.

DERMATEMYS MAWII IN BELIZE

T. R. Rainwater et al. [2012, *Chelonian Conservation and Biology* 11(1):97-107] note that Central American river turtles (*Dermatemys mawii*) are large Critically Endangered freshwater turtles historically found in the coastal lowlands of southern Mexico, northern Guatemala, and Belize. Due to years of intense harvesting for meat, *D. mawii* has been virtually eliminated from much of its former range in southern Mexico; its status in Guatemala remains unclear. During April and May 2010, the authors conducted a countrywide survey in Belize to assess the current conservation status of *D. mawii* in what is believed to be its last stronghold. Approximately 30 localities were surveyed, from deep southern to extreme northern Belize, including 17 areas previously surveyed during the early 1980s and 1990s. Results indicate *D. mawii* is heavily depleted in most of Belize, but healthy populations remain in a few remote areas, especially those receiving some level of protection. While this mirrors the trend observed in previous surveys, the current findings are of particular concern because the number of localities where turtles were observed and the number of turtles observed at these localities were both much reduced compared to earlier surveys. Large turtles (reproductive adults) continue to be targeted during harvests, significantly reducing the most demographically important segment of the population. Further, interviews with fishermen and hunters indicate that laws and regulations enacted for the protection of *D. mawii* are largely ignored by locals.

Unofficial Minutes of the CHS Board Meeting, August 17, 2012

The meeting was called to order at 7:53 P.M. at the Schaumburg Public Library. Board members Barbara Khan and Aaron LaForge were absent.

Officers' Reports

Recording Secretary: The minutes of the July 13, 2012, board meeting were read and accepted.

Treasurer: The July financial report was presented and accepted. Chicago Wilderness membership is due and will be paid. Printing expenses for the *Bulletin* have been much reduced.

Membership Secretary: Membership numbers are staying around the same. A list of newly expired memberships was read.

Sergeant-at-arms: Attendance at the July general meeting was 35

Committee Reports

Shows:

- Notebaert, first full weekend of each month. Josh Chernoff is coordinator.
- Westmont Pet Event, September 15, 10 A.M. – 2 P.M. We will have a tent or pavilion.
- Blessing of the Pets, Pullman, October 7, 1 – 4 P.M.
- Notebaert (Halloween), October 30.
- Garfield Park Conservatory (Halloween), October 31, 4 – 8 P.M.

Old Business

Promoting articles for the Bulletin: Jason will write an article on preventing fires and carbon monoxide emergencies for herp keepers.

Junior Herpers club: Details are still being worked out. Steve Sullivan will contact the Notebaert to ask for permission to hold the meetings there. November 4, 1–2 P.M. is the tentative first meeting. Jason is still looking for volunteers to help with this.

National Herpetological Society: They are getting a full board together.

Banners: Jason had one banner made and is taking opinions and suggestions before having more made. We also need signs regarding hand sanitizing and sanitizer at ALL events, required by our insurance.

Conservation: Mike found no recent information about DAPTF, so it was decided to not send them a donation at this time. This reduces the donation amount to \$5000.

NARBC, Oct. 13-14: We need to staff our tables during all show hours.

Raffle items: Dick will take over storage of raffle items, and will run the raffle with Josh.

New Business

Herps of Illinois page on our website: Aaron is looking for pictures to update the page.

International Herpetological Symposium: They are hoping to increase attendance by offering two free admissions to each

society which will advertise the symposium in their publication. It will be held in July 2013.

Board meeting site: We will need to start looking for an alternative meeting site.

Reptilefest has a facebook page.

Facebook: Questions/concerns were raised about content on our facebook page. We do have people monitoring the posts on our page.

Awards: Jim Foster is starting to organize the 2012 awards.

Round Table

Nancy Kloskowski's checkered gartersnake had 5 babies—all albinos.

Deb Krohn has a couple of waxy monkey frogs—her son Nick likes them!

Dick: Repticon went well. He ran into the Humberts' daughter Rena on the way home.

Jessica Tschampa has been really busy with art shows. Big news—she is engaged! The wedding date is set for Sept. 28, 2013.

Bob Bavirsha will look into sanitizing posters and bring samples. The fest flyer needs to be updated on the website, and he would like to get cards earlier this year.

Jim Foster was on vacation in Kentucky and stopped at the Kentucky Reptile Zoo.

Linda and Andy Malawy went to Arizona to see their first grandchild, Michael's daughter.

The meeting was adjourned at 9:28 P.M.

Respectfully submitted by Jenny Vollman



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For sale: High quality, all locally captive-hatched tortoises, all bred and hatched here in the upper midwest. Baby leopards, Sri Lankan stars, and pancakes usually available, and are all well-started and feeding great! Leopards are \$125 ea., Sri Lankans (2012 hatched) \$475 ea. And Pancakes are \$195 ea. Leopards for out of state sale/shipping require a veterinary health certificate (inquire for cost). E-mail at KKranz1@wi.rr.com or call Jim or Kirsten at 262 654 6303.

Herp tours: **Costa Rica herping adventures**. Join a small group of fellow herpers for 7 herp-filled days. We find all types of herps, mammals, birds, and insects, but our target is snakes. We average 52 per trip, and this is our 10th year doing it. If you would like to enjoy finding herps in the wild and sleep in a bed at night with air-conditioning, hot water and only unpack your suitcase once, instead of daily, then this is the place to do it. Go to our web-site <http://hiss-n-things.com> and read the highlights of our trips. Read the statistics of each trip and visit the link showing photos of the 40 different species we have found along the way. E-mail at jim.kavney@gmail.com or call Jim Kavney, 305-664-2881.

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, September 26, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Jeff Lemm**, of the San Diego Zoo's Institute for Conservation Research, will speak on "Rock Iguanas: Conservation of the World's Most Endangered Lizards." In addition to rock iguanas, Jeff's professional research interests include monitor lizards and native Southern California herpetofauna. Jeff also enjoys photographing wildlife and has traveled extensively throughout the world in search of his subjects.

At the October 31 meeting **Gerold Merker**, a private breeder from northern California, will speak to us about rosy boas. Gerold is a co-author of *Rosy Boas: Patterns in Time* and several other books.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

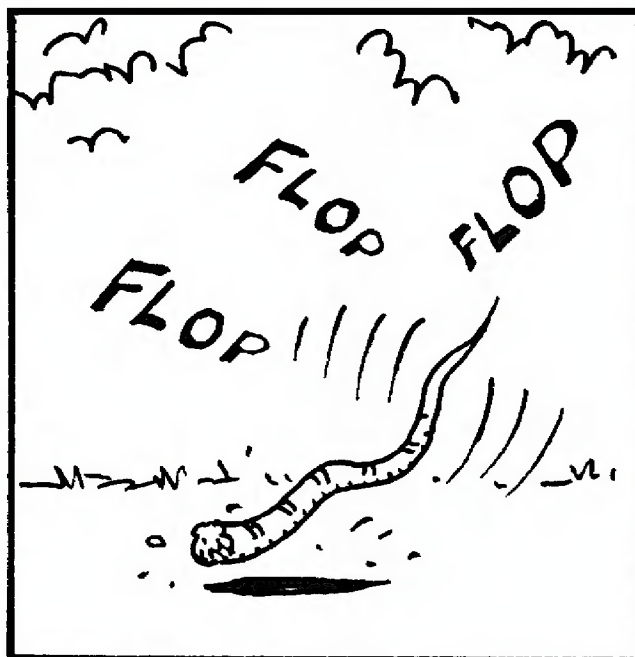
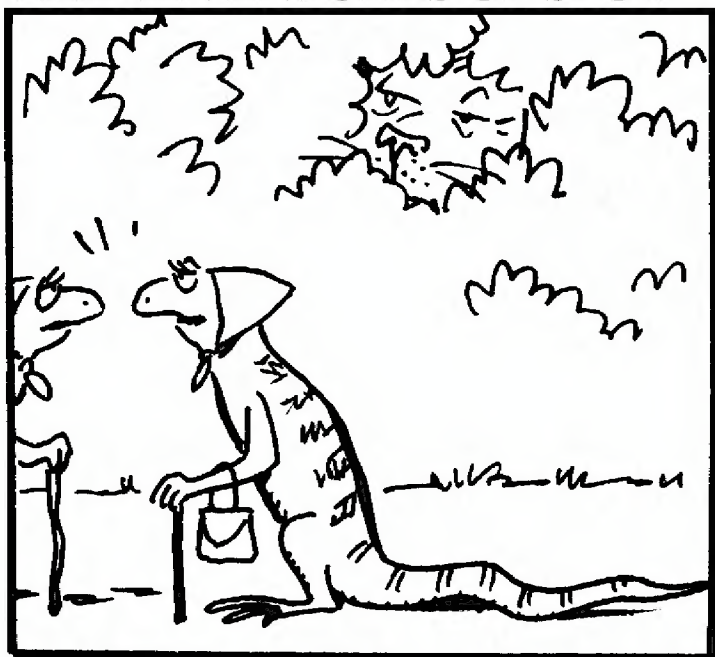
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., October 19, in the adult meeting room on the second floor of the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group's Facebook page.

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